CORPORATE ADAPTATION AND DIVERSIFICATION RESPONSES TO CLIMATE ADVERSITY IN THE U.S. SKI INDUSTRY: A RESILIENCE PERSPECTIVE

We all would like to think of ourselves as resilient. Resilience encompasses the capability to cope with change, the ability to recover from adversity, and the capacity to thrive after facing challenges. In the organizational context, a firm is considered resilient when it is able to experience disturbances and still maintain its function and structure, or bounce back to an original or stronger position (Linnenluecke & Griffiths, 2013; Weick & Sutcliffe, 2007). Despite these foundations, however, research on organizational resilience is still fragmented (Yang et al., 2014) and ample room remains for refining the concept in both theoretical and empirical terms (Linnenluecke, 2013). In addition, previous research on organizational resilience has not yet sufficiently taken a systemic approach (Yang et al., 2014), one that for instance, examines how resilience at the firm level may be intertwined with the dynamics of the firm's wider operating environment, in particular its natural environment (Linnenluecke & Griffiths, 2013).

The question of how firms can build resilience to climate change can be considered an especially salient one, as businesses appear to be increasingly impacted by variations in the climate (Howard-Grenville et al., 2014). The way in which firms may perceive and evaluate adverse climate conditions, and subsequently implement response strategies, whether in terms of adaptation to protect their core business or diversification toward new activities, can have implications for whether firms are able to remain resilient (or not) in the face of climate impacts (Hoffman et al., 2009). Certain sectors appear to be more sensitive than others to climate adversity, especially those that directly depend on local ecosystems (Starik & Rands, 1995), such as agriculture, forestry, tourism, or energy, among others (Linnenluecke et al., 2013). Firms in these sectors can face additional challenges, as potential adaptive actions may still be vulnerable to adverse climate conditions, in addition to relying upon ecosystem services that may also be affected by these conditions (MEA, 2005).

Our paper thus seeks to explore the following research questions: *How do firms respond to climate adversity when adaptation strategies to protect their core business are also susceptible to adverse climate conditions? And, what is the relationship between firm adaptation strategies and local ecosystem service quality under increasing climate adversity?*

In exploring these questions, we aim to contribute to the development of a theoretical bridge with the burgeoning socioecological systems literature, where resilience theory has evolved in a way that can potentially help extend the concept of resilience in the organizational context. Organizational resilience currently focuses mainly on firm *adaption* to disturbances and may not yet fully include two important tensions that have been developed in the socioecological systems literature. The first tension pertains to the idea that systems are able to counteract disturbance pressures through adaptation, thus enabling a given system to maintain its defining components, functions and structures (Folke et al., 2010). As disturbance pressures increase, however, what had previously proven to be successful adaptation may no longer be sufficient to match disturbance levels and may become increasingly unviable (Linnenluecke & Griffiths, 2010). A second tension exists between adaptation and what the literature terms transformation, or the extent to which a given system is able to establish a new set of components, functions and structures (Walker et al., 2004). As adaptation becomes increasingly difficult due to high levels of disturbance, rather than collapse, a system may be instead be able to transform and redefine itself (Adger, 2009; Folke et al., 2010). Resilience theory suggests that adaptation and transformation may thus represent successive and repetitive phases in a system's resilience

building process (Gunderson, 2000; Folke et al., 2010). Therefore, resilient systems in this literature are not just defined by adaptation, but by the ability to undertake adaptation followed by transformation when necessary, and being able to do so repeatedly.

Applying this resilience logic to the organizational context led us to present the following arguments. First, increasing climate adversity may be alerting firms to the reality that available core business adaptation actions may no longer match the level of threat being experienced (Whiteman & Cooper, 2011). We expect this to be the case especially when adaptation actions are also susceptible to climate adversity, as these actions may be becoming increasingly unviable in terms of costliness and effectiveness. We therefore predict that higher climate adversity may lead firms to actually engage in less adaptation over time. Second, we further argue that firms may instead undertake more diversification, which may constitute a precursor to a more complete transformation toward new business activities that are less or unaffected by climate impacts. We predict that this transition from adaptation to diversification may be heightened under higher climate adversity. Third, we posit that when adaptation actions depend on local ecosystem services, such actions may have potentially negative spillover effects on the quality of these ecosystem services, which may be magnified by higher climate adversity. Examining this third relationship is salient to the extent that these compounded impacts may induce changes in the provisioning of local ecosystem services, which may subsequently feedback to constrain firms in their ability to carry out additional adaptation actions (Nelson et al., 2007).

We tested these ideas in the context of the western U.S. ski industry, which can be considered a "canary in the coal mine" sector that has been dealing with the implications of climate variation for its core business over several decades (NRDC, 2012; Tashman & Rivera, 2011). In terms of core business adaptation actions, ski areas implement artificial snowmaking to supplement and even replace natural snow cover, as well as slope expansion into more climatically favorable areas, such as higher elevations or north facing mountain slopes, in order to capitalize on colder temperatures and longer lasting snow cover (Hoffman et al., 2009; Scott & McBoyle, 2007). The main challenge, however, is that the projected trend toward warming temperatures and decreasing natural snowfall may be affecting the degree to which ski areas can viably implement artificial snowmaking and slope expansion (NRDC, 2012). In addition, these actions can have negative impacts on surrounding ecosystems, particularly on water resources (Clifford, 2002). Instead, this trend may be pushing ski areas to diversify toward alternate year-round revenue streams, such as commercial and residential real estate development for example, which has seen increasing investment from the industry over the years (SACC, 2012).

In terms of methodology, we collected longitudinal data for a sample of western U.S. ski areas from 2001-2013. Key constructs were operationalized using the following measures and data sources: (i) acres of artificial snowmaking and acres of slope expansion captured ski area core business adaptation and were obtained from the Ski Area Citizen's Coalition (SACC), an environmental non-governmental organization; (ii) acres of real estate construction captured ski area diversification and were also obtained from SACC; (iii) average temperature during the ski season captured climate adversity and was obtained from the National Oceanographic and Atmospheric Administration; and (iv) downstream water quality captured local ecosystem service quality and was obtained from the United States Geological Survey. We used fixed and random effects panel regression models to test our hypotheses and found overall support for our predictions. Future extensions of the paper could further harness geospatial tools, remote sensing in particular, to expand the sample toward ski areas that may have potentially closed down and/or ski areas that are located in more sensitive lower altitude regions, such as the Northeast.

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